13 $\sum_{n=1}^{\infty} n \cdot \sin\left(\frac{1}{n}\right) \not\to 0$

$a_n \not\to 0$

$a_n \to 1$

the series diverges by the n^{th} term test

$\lim_{n\to\infty} n \sin\left(\frac{1}{n}\right)$ $\infty \cdot 0$

$\lim_{n\to\infty} \frac{\sin \frac{1}{n}}{\frac{1}{n}}$ $\frac{0}{0}$

let $\theta = \frac{1}{n}$

as $n \to \infty$

$\theta \to 0$

$\lim_{\theta\to 0} \frac{\sin\theta}{\theta} = 1$

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17. $\sum_{n=1}^{\infty} \frac{3^{n-1}+1}{3^n}$ diverges by the n^{th} term test

ratio test $\lim_{n\to\infty} \frac{3^{n}+1}{\cancel{3^{n+1}}} \cdot \frac{\cancel{3^{n}}}{\cancel{3^{n-1}}+1} = 1$ inconclusive

ignore

ignore

n^{th} term $\lim_{n\to\infty} \frac{\cancel{3^{n-1}}+1}{3^n} = \frac{1}{3} \neq 0$

$a_n \not\to 0$

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16.

$$\sum_{n=1}^{\infty} \frac{5n^3-3n}{n^2(n+2)(n^2+5)} < \leq \sum \frac{5n^3}{n^5} = \sum \frac{5}{n^2}$$

converges by direct comparison

p series

$p=2$

converges

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9.5 absolute convergence vs. conditional convergence

if $\sum |a_n|$ converges then $\sum a_n$ converges

$\sum |a_n|$ diverges

$\sum a_n$ converges

use a test

alt. series test

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$$\sum_{n=1}^{\infty}(-1)^{n+1}\frac{1}{n} = 1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+\frac{1}{5}\cdots$$

alternating harmonic series

does it converge ~~absolutely~~, conditionally or neither?

abs?: $\sum_{n=1}^{\infty}\left|(-1)^{n+1}\frac{1}{n}\right| = \sum_{n=1}^{\infty}\frac{1}{n} = 1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}\cdots$

harmonic series

diverges

$$\sum(-1)^{n+1}\frac{1}{n} = 1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}\cdots$$

alt. series test

1. signs alt. ✓
2. |terms| get smaller ✓
3. $a_n \to 0$ ✓

$\lim_{n\to\infty}\frac{1}{n}=0$

converges by the alt. series test

converges conditionally

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$$1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+\cdots = ?$$

$$\ln(1+x) = x-\frac{x^2}{2}+\frac{x^3}{3}-\frac{x^4}{4}\cdots$$

let $x=1$

$$\ln 2 = 1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}\cdots$$

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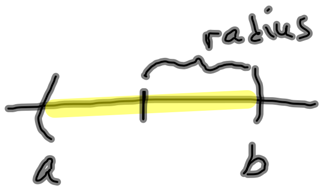
Intervals of convergence – the values of x for which a series converges



$a < x < b$

1. interior
2. end points $x = a$ $\sum$

   $x = b$ $\sum$

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p520 #6a $\sum_{n=1}^{\infty} (-1)^{n+1} \frac{x^{2n}}{2n}$ find the interval of convergence ioc

start with a ratio test $\lim_{n\to\infty} \left| \frac{x^{\cancel{2(n+1)}}}{2(n+1)} \cdot \frac{2n}{\cancel{x^{2n}}} \right|$

$\frac{x^{2n+2}}{x^{2n}} = x^{2n+2-2n} = x^2$

$\lim_{n\to\infty} \left| x^2 \cdot \frac{2n}{2n+2} \right| = x^2 < 1$ ($\frac{2n}{2n+2} \to 1$)

$-1 \leq x \leq 1$

interior

endpoints:

$x = -1$

plug in original series $\sum (-1)^{n+1} \frac{(-1)^{2n}}{2n}$

$\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{2n} = \frac{1}{2} - \frac{1}{4} + \frac{1}{6} \dots$

converges by AST

other endpt

$x = 1$

$\sum (-1)^{n+1} \frac{1^{2n}}{2n}$

converges by AST

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